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## Warming Bad – Extinction

### Warming is an existential threat

Mazo 10 – PhD in Paleoclimatology from UCLA

Jeffrey Mazo, Managing Editor, Survival and Research Fellow for Environmental Security and Science Policy at the International Institute for Strategic Studies in London, 3-2010, “Climate Conflict: How global warming threatens security and what to do about it,” pg. 122

The best estimates for global warming to the end of the century range from 2.5-4.~C above pre-industrial levels, depending on the scenario. Even in the best-case scenario, the low end of the likely range is 1.goC, and in the worst 'business as usual' projections, which actual emissions have been matching, the range of likely warming runs from 3.1--7.1°C. Even keeping emissions at constant 2000 levels (which have already been exceeded), global temperature would still be expected to reach 1.2°C (O'9""1.5°C)above pre-industrial levels by the end of the century." Without early and severe reductions in emissions, the effects of climate change in the second half of the twenty-first century are likely to be catastrophic for the stability and security of countries in the developing world - not to mention the associated human tragedy. Climate change could even undermine the strength and stability of emerging and advanced economies, beyond the knock-on effects on security of widespread state failure and collapse in developing countries.' And although they have been condemned as melodramatic and alarmist, many informed observers believe that unmitigated climate change beyond the end of the century could pose an existential threat to civilisation." What is certain is that there is no precedent in human experience for such rapid change or such climatic conditions, and even in the best case adaptation to these extremes would mean profound social, cultural and political changes.

## Warming Bad – Phytoplankton

### Climate Change destroys phytoplankton

Stephen Daniells June 10, 2011 Science Editor , [Decision News Media](http://fr.linkedin.com/company/william-reed-business-media-france?trk=ppro_cprof) Post-doctoral reseacher , [Technical University of Delft](http://fr.linkedin.com/company/technical-university-of-delft?trk=ppro_cprof) Climate change may affect global omega-3 supplies: Harvard professor http://www.nutraingredients-usa.com/On-your-radar/Omega-3/Climate-change-may-affect-global-omega-3-supplies-Harvard-professor

Changes to the world’s ecosystems as a result of climate change will decrease levels of phytoplankton in the world’s oceans, and alternative sources like GM crops must fill the void, says a Harvard PhD. According to an article in [Biotechnology](http://www.nutraingredients-usa.com/content/search?SearchText=biotechnology&FromNews) Advances, climate change will produce increases in ocean temperature, and levels of carbon dioxide n the atmosphere and UV radiation. These will all work against the growth of phytoplankton in the world’s oceans. A drop in the planet’s population of phytoplankton – the primary producers of [omega-3](http://www.nutraingredients-usa.com/content/search?SearchText=omega-3&FromNews) fatty acids – will also reduce the availability of omega-3s in our diets. The article is authored by Jing Kang, MD, PhD, associate professor of medicine at Harvard Medical School and director of the Laboratory for Lipid Medicine and Technology (LLMT) at Massachusetts General Hospital. “Omega-3 PUFAs are undeniably significant factors in human health, yet their availability is being threatened by the consequences of global climate change,” wrote Dr Kang. “The foremost issue at hand, of course, is that we make every attempt to counter global climate change and its harmful effects. In the meantime, as we fend off the immediate health repercussions, we must also look to other methods of obtaining our omega-3 PUFA quotient.”

### Phytoplankton are the foundation of the food chain and produce half of the worlds oxygen—killing them risks extinction

UPI June 6, 2008

(http://www.upi.com/Energy\_Resources/2008/06/06/Acidic\_oceans\_may\_tangle\_food\_chain/UPI-84651212763771/print/)

Increased carbon levels in ocean water could have devastating impacts on marine life, scientists testified Thursday at a congressional hearing. Although most of the concern about carbon emissions has focused on the atmosphere and resulting temperature changes, accumulation of carbon dioxide in the ocean also could have disturbing outcomes, experts said at the hearing, which examined legislation that would create a program to study how the ocean responds to increased carbon levels. Ocean surface waters quickly absorb carbon dioxide from the atmosphere, so as carbon concentrations rise in the skies, they also skyrocket in the watery depths that cover almost 70 percent of the planet. As carbon dioxide increases in oceans, the acidity of the water also rises, and this change could affect a wide variety of organisms, said Scott Doney, senior scientist at the Woods Hole Oceanographic Institution, a non-profit research institute based in Woods Hole, Mass. "Greater acidity slows the growth or even dissolves ocean plant and animal shells built from calcium carbonate," Doney told representatives in the House Committee on Energy and the Environment. "Acidification thus threatens a wide range of marine organisms, from microscopic plankton and shellfish to massive coral reefs." If small organisms, like phytoplankton, are knocked out by acidity, the ripples would be far-reaching, said David Adamec, head of ocean sciences at the National Aeronautics and Space Administration. "If the amount of phytoplankton is reduced, you reduce the amount of photosynthesis going on in the ocean," Adamec told United Press International. "Those little guys are responsible for half of the oxygen you're breathing right now." A hit to microscopic organisms can also bring down a whole food chain. For instance, several years ago, an El Nino event wiped out the phytoplankton near the Galapagos Islands. That year, juvenile bird and seal populations almost disappeared. If ocean acidity stunted phytoplankton populations like the El Nino did that year, a similar result would occur -- but it would last for much longer than one year, potentially leading to extinction for some species, Adamec said. While it's clear increased acidity makes it difficult for phytoplankton to thrive, scientists don't know what level of acidity will result in catastrophic damages, said Wayne Esaias, a NASA oceanographer. "There's no hard and fast number we can use," he told UPI. In fact, although scientists can guess at the impacts of acidity, no one's sure what will happen in reality. Rep. Roscoe Bartlett, R-Md., pointed to this uncertainty at Thursday's hearing. "The ocean will be very different with increased levels of carbon dioxide, but I don't know if it will be better or worse," Bartlett said. However, even though it's not clear what the changes will be, the risk of doing nothing could be disastrous for ecosystems, said Ken Caldeira, a scientist at the Carnegie Institution for Science, a non-profit research organization. "The systems that are adapted to very precise chemical or climatological conditions will disappear and be replaced by species which, on land, we call weeds," Caldeira said. "What is the level of irreversible environmental risk that you're willing to take?" It's precisely this uncertainty that the Federal Ocean Acidification Research and Monitoring Act attempts to address. The bill creates a federal committee within the National Oceanic and Atmospheric Administration to monitor carbon dioxide levels in ocean waters and research the impacts of acidification. like Bishop. "We would lose everything," he told UPI.

## A2: CO2 Good – Agriculture 1/3

### The effects on plant growth their evidence references have reversed. New evidence proves

The Associated Press 20 August 2010 08:48 AM (<http://www.dallasnews.com/news/nation-world/nation/20100820-Global-warming-linked-to-decline-in-525.ece>)

Plant growth that had been spurred by global warming has reversed, despite temperatures that continue to rise. Researchers say the change could affect food security and development of biofuels. The amount of carbon taken up by growing plants increased from 1982 through 1999 as temperatures rose and the amount of carbon dioxide in the atmosphere increased. But a new study in today's edition of the journal Science found a drought-related decline in such plant growth from 2000 to 2009, even though temperatures continued to climb. As drought caused by warming reduces the land's ability to take up carbon, the result could be more carbon dioxide left in the atmosphere, and thus more warming, Maosheng Zhao of the University of Montana explained in a telephone interview. "This is a pretty serious warning that warmer temperatures are not going to endlessly improve plant growth," co-author Steven W. Running, also of the University of Montana, said in a statement. "We see this as a bit of a surprise, and potentially significant on a policy level because previous interpretations suggested global warming might actually help plant growth around the world," he said. Instead, he and Zhao found a small but measurable decline of about 1 percent, compared to a 6 percent increase in the 1980s and '90s. Their study, based on data collected by NASA satellites, found that northerly areas continued to increase plant growth, thanks to warmer temperatures and a longer growing season. But that was more than offset by warming-associated drought in the Southern Hemisphere. The research was supported by NASA and the National Oceanic and Atmospheric Administration.

### Rising global warming leads to increase in pests—kills any benefit of increased crop yields

Union of Concerned Scientists May 11, 2010 Crops, Beetles and Carbon Dioxide: Will Global Warming Bring More Voracious Insects to Farms? http://www.ucsusa.org/global\_warming/science\_and\_impacts/impacts/Global-warming-insects.html

As spring warms the heartland, farmers prepare to plant, and soon the nation's flat brown fields will be green with corn, soybeans, and other staple crops. But as the carbon dioxide in the atmosphere skyrockets and the climate changes, will farmers be able to grow enough crops to feed the nine billion people expected to be living on the planet by midcentury? It may be harder than many had assumed, according to recent studies on experimental farm plots in Illinois. That's because rising carbon dioxide levels could allow insect pests to take a bigger bite out of crops, thereby reducing yields. After rising carbon dioxide emissions and climate change were recognized as a looming global problem, agronomists began testing how crop plants would respond. They knew that raising levels of carbon dioxide accelerated the photosynthetic machinery in most crop plants, and they hypothesized that crops would grow faster and yield more, says plant biologist Evan DeLucia of the University of Illinois, Urbana-Champaign (UIUC). What's more, early tests of this hypothesis—in greenhouses, growth chambers, and open-top enclosures in the field—seemed to confirm it. Climate change contrarians crowed, claiming that rising carbon dioxide levels would lead to a "greening earth."

A2: CO2 Good – Agriculture 2/3

### And, CO2 isn’t the only effector on plant growth. Many factors must be considered

Stanford Report, December 11, 2002

The prevailing view among scientists is that global climate change may prove beneficial to many farmers and foresters -- at least in the short term. The logic is straightforward: Plants need atmospheric carbon dioxide to produce food, and by emitting more carbon dioxide into the air, our cars and factories create new sources of plant nutrition that will cause some crops and trees to grow bigger and faster. But an unprecedented three-year experiment conducted at Stanford University is raising questions about that long-held assumption. Writing in the journal *Science*, researchers concluded that elevated atmospheric carbon dioxide actually reduces plant growth when combined with other likely consequences of climate change -- namely, higher temperatures, increased precipitation or increased nitrogen deposits in the soil. The results of the study may prompt researchers and policymakers to rethink one of the standard arguments against taking action to prevent global warming: that natural ecosystems will minimize the problem of fossil fuel emissions by transferring large amounts of carbon in the atmosphere to plants and soils. "Perhaps we won't get as much help with the carbon problem as we thought we could, and we will need to put more emphasis on both managing vegetation and reducing emissions," said Harold A. Mooney, the Paul S. Achilles Professor of Environmental Biology at Stanford and co-author of the Dec. 6 *Science* study. He noted that the Stanford study is the first ecosystem-scale experiment to apply four climate change factors across several generations of plants. "To understand complex ecological systems, the traditional approach of isolating one factor and looking at that response, then extrapolating to the whole system, is often not correct," Mooney said. "On an ecosystem scale, many interacting factors may be involved." Jasper Ridge Global Change Project The findings published in *Science* are among the first results of the Jasper Ridge Global Change Project -- a multi-year experiment designed to demonstrate how a typical California grassland ecosystem will respond to future global environmental changes. Located in a fenced off section of Stanford's 1,189-acre Jasper Ridge Biological Preserve, the novel experiment was designed to simulate environmental conditions that climate experts predict may exist 100 years from now: a doubling of atmospheric carbon dioxide; a temperature rise of 2 degrees Fahrenheit; a 50 percent increase in precipitation; and increased nitrogen deposition -- largely a byproduct of fossil fuel burning. Launched in 1997, the Jasper Ridge experiment was conceived by Mooney and Christopher B. Field, a professor by courtesy in Stanford's Department of Biological Sciences and director of the Carnegie Institution's Department of Global Ecology, also located on the Stanford campus. "Most studies have looked at the effects of carbon dioxide on plants in pots or on very simple ecosystems and concluded that plants are going to grow faster in the future," said Field, co-author of the Science study. "We got exactly the same results when we applied carbon dioxide alone, but when we factored in realistic treatments -- warming, changes in nitrogen deposition, changes in precipitation -- growth was actually suppressed." To mimic future climate conditions, Field, Mooney and their colleagues mapped out 36 circular plots of land, each about 6 feet in diameter. Four plots are virtually untouched, receiving no additional water, nitrogen, carbon dioxide or heat. Each of the remaining 32 circles is divided into four equal quadrants separated by underground partitions to prevent roots in one section from invading neighboring tracts. In these smaller quadrants, researchers study all 16 possible combinations of elevated and normal carbon dioxide, heat, water and nitrogen. The plots thicken The biggest surprise from the study was the discovery that elevated carbon dioxide only stimulated plant growth when nitrogen, water and temperature were kept at normal levels. "Based on earlier single-treatment studies with elevated carbon dioxide, we initially hypothesized that, with the combination of all four treatments together, the response would be additional growth," said W. Rebecca Shaw, a researcher with the Nature Conservancy of California and lead author of the Science study. But results from the third year of the experiment revealed a more complex scenario. While treatments involving increased temperature, nitrogen deposition or precipitation -- alone or in combination -- promoted plant growth, the addition of elevated carbon dioxide consistently dampened those increases. "The three-factor combination of increased temperature, precipitation and nitrogen deposition produced the largest stimulation [an 84 percent increase], but adding carbon dioxide reduced this to 40 percent," Shaw and her colleagues wrote. The mean net plant growth for all treatment combinations with elevated carbon dioxide was about 4.9 tons per acre -- compared to roughly 5.5 tons per acre for all treatment combinations in which carbon dioxide levels were kept normal. However, when higher amounts of carbon dioxide gas were added to plots with normal temperature, moisture and nitrogen levels, aboveground plant growth increased by nearly a third. Why would elevated carbon dioxide in combination with other factors have a suppressive effect on plant growth? The researchers aren't sure, but one possibility is that excess carbon in the soil is allowing microbes to outcompete plants for one or more limiting nutrients. "By applying all four treatments, we may be repositioning the ecosystem so that another environmental factor becomes limiting to growth," Field observed. "For example, by increasing plant growth as a result of adding water or nitrogen, the ecosystem may become more sensitive to limitation by another mineral nutrient such as phosphorous, potassium or something else we hadn't been measuring." A new five-year experiment is under way at the Jasper Ridge site to analyze potential limiting nutrients in the soil along with microbial-plant interactions and the molecular biology of the vegetation. Policy implications Field and his colleagues say that their ultimate goal is to use the results of the Jasper Ridge study to forecast what will happen to other ecosystems -- from alpine tundra to tropical rainforests. "In the past, people have argued that perhaps we don't really need to worry about fossil fuel emissions, because increased plant growth will effectively pull elevated carbon dioxide concentrations out of the atmosphere and keep the world at the appropriate equilibrium," he added. "But our experiment shows that we can't count on the natural world, the unmanaged world, to save us by pulling down all the atmospheric carbon dioxide." Added Mooney: "Our study demonstrates that there is still a lot to learn about the factors that regulate global climate change. But we also know a lot already, more than enough to engage in a serious discussion about action to reduce carbon dioxide emissions from burning fossil fuels and clearing forests." Other coauthors of the Science study are former Stanford doctoral student Erika S. Zavaleta, now a Nature Conservancy postdoctoral fellow at the University of California-Berkeley; Nona R. Chiariello, research coordinator of Stanford's Jasper Ridge Biological Preserve; and Elsa E. Cleland, a graduate student in the Stanford Department of Biological Sciences. The study was supported by the National Science Foundation, the Morgan Family Foundation, the David and Lucile Packard Foundation, the Jasper Ridge Biological Preserve, the Carnegie Institution of Washington, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Switzer Foundation and the A. W. Mellon Foundation.

## A2: CO2 Good – Disease 1/4

### Disease outbreak inevitable in global warming scenario

Claire L Parkinson is a climatologist at NASA's Goddard Space Flight Center, where she's worked since July 1978, with a research emphasis on sea ice and its role in the global climate system. Claire has a B.A. in mathematics from Wellesley College and a Ph.D. in climatology from Ohio State University. She is a fellow of both the American Meteorological Society and Phi Beta Kappa. 2010 The Coming Climate Crisis

A biologically based concern in the opposite direction from the concern over ex­tinctions is the concern that changing climatic conditions might expand the range of species and diseases that we would prefer to avoid, like the observed poleward expansion of the red fire ant, destroying native flora and fauna as they advance.56 Warmer temperatures, increased rainfall, and the absence of subzero temperatures are all factors that can lead to extending the ranges of insects, rodents, and other organisms that carry diseases and otherwise cause problems for humans and other species. Among the most notable examples are the expansions to higher latitudes of diseases that often are associated largely with the tropics, such as malaria (see qualifiers later in this chapter), hookworm, schistosomiasis, dengue fever, leprosy, guinea worm, and West Nile disease. Other diseases likely to spread with warmer temperatures are Rocky Mountain spotted fever, Q fever, and Lyme disease, the latter already notably spreading in the United States and Europe,57 and tick-borne encephalitis, already increasing substantially in Sweden since the mid-1980s.58Health is also affected by warming through the influence that warming has on sea level rise and the consequent likelihood of increased saltwater intrusion into freshwater areas and increased saltwater flooding. More severe flooding raises not just the risk of flood damage but also the risk of such waterborne diseases as chol­era, typhoid, and dysentery and such mosquito-borne diseases as yellow fever and malaria. Malaria, which is transmitted by mosquitoes, already results in a million deaths each year and has the potential of resulting in many more deaths, as higher temperatures in many regions will be more conducive to mosquito outbreaks.59 Other factors are involved as well, however, as described later in this chapter.

A2: CO2 Good – Disease 2/4

### The disease fighting their card talks about is from vitamin C from citrus foods – vitamin C DOESN'T prevent disease. There are like fifty studies in here. Just move on to your next turn.

Charles W. Marshall, Ph.D May 18, 2002 (Marshall was a biochemist who devoted most of his retirement to investigating the benefits and risks of vitamin supplementation) (Vitamin C: Do High Doses Prevent Colds?) (http://www.quackwatch.org/01QuackeryRelatedTopics/DSH/colds.html)

One way to test whether high-dosage vitamin C prevents colds is to inoculate the throats of volunteers with cold viruses. Two studies of this type found that everyone got colds whether they took vitamin C or not. Walker and co-workers in 1967 and Schwartz, Hornick and associates in 1972-73 gave half of their volunteers a placebo and the rest 3,000 mg of vitamin C daily for several days before inserting live cold viruses directly into their noses; and then continued 3,000 mg of vitamin C (or placebo) for seven more days. All of the volunteers got colds, which were of equal severity [9-11]. Another way to test vitamin C is to see what happens to matched groups over a period of time. Two teams of investigators have done this more than once, one team led by Dr. John L. Coulehan and the other by Dr. Terence Anderson. Dr. Coulehan's first study was done on 641 Navajo Indian children, half of whom received a placebo while the rest received 1,000 mg of vitamin C daily. A complicated system of judging the severity of head, throat and chest symptoms was used. The Coulehan team reported in 1974 that the vitamin C group had less severe colds, but other scientists who reviewed the study criticized the method of judging the severity of symptoms [12]. So in 1976 the Coulehan team repeated their study with 868 Navajo children but used a better system of scoring severity. The children receiving vitamin C averaged 0.38 colds per person while the placebo group averaged 0.37. The average duration of the colds was 5.5 days in the vitamin group and 5.8 in the placebo group. Thus, in this test, vitamin C neither prevented colds nor shortened their duration [13]. In 1979, Dr. Coulehan published his analysis of vitamin C versus the common cold and concluded that extra vitamin C is not worth taking [14]. In 1972, Dr. Terence Anderson and colleagues at the University of Toronto published the results of a 3-month double-blind study of 818 volunteers aged 10 to 65. Half received 1,000 mg of vitamin C daily before colds and 4,000 mg per day during the first 3 days of a cold, while the other half received "equivalent" placebos [15]. This study was designed to test Pauling's claims that ingestion of 1,000 mg of vitamin C daily would reduce the frequency of colds by 45% and the total days of illness by 60%. These claims were certainly not supported by the study's outcome. In the vitamin group, 74% had one or more colds during the study period while 82% of the placebo group had one or more colds. The difference, which amounted to "one-tenth of a cold per person," was judged by Dr. Anderson to be "of no practical importance." The severity, as measured by days confined indoors, averaged 1.36 days for the vitamin group and 1.87 days for the placebo group -- a 30% difference that Anderson decided to explore further. At the end of this trial, before the double-blind code was opened, all volunteers were asked whether they had experienced any unusual feelings of well-being [euphoria] during the trial. Nineteen percent of both groups said yes -- an interesting example of the placebo effect In 1974, the Anderson team , reported on a larger trial to see what results would be obtained with different amounts of vitamin C [16,17]. Some 3,500 volunteers were divided into eight groups, six of which received various daily dosages of vitamin C while the others received placebos for 3 months. No difference in the incidence of colds was found among the groups taking no vitamin C, 250 mg, 1,000 mg or 2,000 mg daily. A possible slight reduction in severity of symptoms was found in the vitamin C groups, but volunteers taking dosages of 4,000 or 8,000 per day when a cold began did no better than those taking only 250 mg per day. The third Anderson trial, reported in 1975, covered 16 weeks and used 488 volunteers (ages 14­67), with one-third receiving a pill of vitamin C as its sodium and calcium salts, and one-third given vitamin C in slow-release capsules, and one-third getting a placebo [18]. The vitamin C dosage was 500 mg once a week (equivalent to about 70 mg daily) before colds, but 1,500 mg the first day of a cold followed by 1,000 mg on the second and third days. No reduction in the incidence of colds was observed, but those taking vitamin C averaged less time at home (1.62 vs. 1.12 days indoors). Do you think that a half-day's less confinement is of practical significance? Taken together, the Anderson studies suggest that extra vitamin C nay slightly reduce the severity of colds, but that it is not necessary to take the high dosages suggested by Pauling to achieve this result. Nor is there anything to be gained by taking vitamin supplements year-round in the hope of preventing colds. In 1975, Carson and co-workers reported treating company employees with 1,000 mg of vitamin C or a placebo daily during colds. The number of colds per person, the duration of colds and their severity were the same in both vitamin and placebo groups [19]. In 1975, Karlowski and associates at the National Institutes of Health reported treating volunteers as follows: 25% received placebos; 25% took 3,000 mg of vitamin C daily before colds but placebos during colds; 25% were given placebos daily before colds and 3,000 mg of vitamin C daily during colds; and 25% got 3,000 mg daily before colds and 6,000 mg daily during colds. The experiment was supposed to be double-blind, but the doctors had failed to make the placebo taste the same as the vitamin C pills as is done in most trials. As a result, half of the volunteers correctly guessed which pill they were getting and therefore became unblinded. When the results were tabulated with all volunteers lumped together, the average number of colds per person was 1.27 colds for the vitamin group and 1.41 for the placebo group. But among those who remained blinded, no differences in the incidence or severity were found [20]. This fascinating result shows how many people who think they are taking a positive step (such as taking a vitamin) may report a favorable result even when none really exists! In 1977, Miller and colleagues 22 treated 44 pairs of identical twins for 5 months as follows. One twin in each pair received a vitamin C capsule while the other got a placebo. The daily vitamin C dosages before and during colds ranged from 500 for younger children to 1,500 mg for older ones. The investigators noted "no significant overall benefit on cold symptoms" as reported by the children's mothers, but the responses varied among the subgroups when the children were divided according to sex and age [21]. After the data were analyzed, four mothers admitted tasting the capsules in an attempt to figure out which twin was getting the vitamin C! Thus it is possible that the ratings of these mothers and possibly others were influenced by guessing which twin was getting the vitamin C. Two studies using identical twins have been reported. In 1977, Tyrell and co-workers reported treating 743 men and 758 women for 5 months as follows. Half received placebo pills daily. The others took vitamin C but only during colds at these dosages: 4,000 mg on the first and second days of a cold and 200 mg on the third day. There was no benefit from taking vitamin C. The incidence and duration of colds were the same for both men and women in the vitamin and placebo groups [22]. Men in both groups missed an average of half a day's work while women missed about a day [23]. The other study, reported in 1981, used 95 pairs of identical twins. One of each pair took 1,000 mg of vitamin C for 100 days while the other received a placebo The vitamin C group had slightly more colds but a shorter duration of colds (5 days instead of 6). [23] An 8-week trial with 764 Marine recruits carried out by Pitt and Costrini was reported in 1979. Half of the recruits received 2,000 mg of vitamin C daily, while the others took placebo pills on the same schedule. No benefit from vitamin C was found. Ninety percent of both groups got colds, and no difference in severity or duration of colds was found [24]. In a 1984 study, Dr. X. H. Briggs 26 divided 528 volunteers and gave half 1,000 mg vitamin C daily and the other half a daily placebos for three months. In the vitamin C group 47% got colds, and 46% of the placebo group. Severity of symptoms lasted on average 3.1 days for the vitamin C group and 3.3 days for those getting placebos. Briggs concluded: No prevention and no benefit [25]. In 1990, Dr. Elliot Dick and coworkers summarized the methods and results of their three double-blind controlled trials to test methods of transmission of viruses, by contaminated fingers or inhaling viruses in the air, and to test the protective effect of vitamin C. They used 24 volunteers, 8 donors and 16 recipients. The recipients were nonsmoking men testing negative for antibodies to the RV16 type cold virus. Half were pretreated for 3 1/2 weeks with 2,000 mg of vitamin C daily (4 x 500 mg), and the other were eight given 4 placebos daily. The eight donors were infected with RV16 cold virus by direct inoculation into the nose and then were housed with the recipients 24 hours a day for a 7-day interaction period. All donors developed colds first and then all 16 of the recipients. The vitamin C or placebo pills were continued during the week of interaction and for the following two weeks. During the 7-day interaction period the men were supervised and slept, ate and played cards in the same room. Results: All got colds [26]. In 2001, an Australian team published the results of a double-blind, randomised clinical trial with four intervention arms: vitamin C at daily doses of 0.03g ("placebo"), 1 g, 3g, or 3g with additives ("Bio-C") taken at onset of a cold and for the following two days. The study included 400 healthy volunteers who were followed over an 18-month period. The participants were instructed to take the pills when they had experienced early symptoms of a cold for four hours, and to record daily their symptoms, severity, doctor visits, and use of other medications. Among the 149 participants who returned records for 184 colds, no significant differences were found from one group to another [27].

A2: CO2 Good – Disease 3/4

### And, Sorry, you’re wrong. Global warming kills people. Lots of people. It causes heat-waves, Increases the likelihood and severity of extreme weather events such as storms and hurricanes, which kill thousands, and also increases the risk of exposure to ozone and diseases

Brenda M. Afzal May 07 (Brenda Afzal is a Director of Health Programs in the Environmental Health Education Center at the University of Maryland School of Nursing) (<http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume122007/No2May07/GlobalWarming.aspx#Afzal>)

The Australian Greenhouse Office of the Australian Department of Environment and Heritage (2005) reported "most climate models indicate that in many places global warming is likely to increase the frequency and duration of extreme events such as heavy rains, droughts, and floods" (p.1). The Intergovernmental Panel on Climate Change (IPCC) has noted that there has already been evidence of increases in the intensity or frequency of some of these extreme events throughout the 20th century (IPPC, 2001a). The United Nations University Institute for Environment and Health Security (UNU-EHS) has reported that the impact of extreme weather events around the globe has already created million’s of environmental refugees (UNU-EHS, 2007). These refugees have been displaced from their homes and countries due to sudden extreme weather events and slower environmental shifts such as an increase in desert area, diminishing water supplies, and rising sea levels. There is mounting evidence that global climate change is already affecting human health through extreme weather events, changes in air and water quality, and changes in the ecology of infectious diseases (Patz, Epstein, Burke, & Balbus, 1996; Stott, Stone, & Allen, 2004). Extreme weather events, such as extremely hot weather, increase the death rates of the elderly and the very young. In 2003, Europe experienced its hottest summer in centuries, with temperatures averaging 3.5º Celsius above normal (Luterbachter, Dietrich, Xoplaki, Goosjean, & Wanner, 2004). Over 22,000 individuals throughout Europe died during or directly after the summer heat wave of 2003 (Kosatsky, 2005). In July of 1995, hundreds of Chicago residents died as a result of a heat wave that reached 106º F, with a heat index of over 120º F (Centers for Disease Control and Prevention, 1995). However, in the 1999 Chicago heat wave, there were fewer deaths. This decrease in deaths may be attributed to lessons learned in 1995 (Naughton et al., 2002). In the summer of 2005, the US experienced firsthand the impact of another extreme weather event when Hurricane Katrina made landfall near New Orleans, Louisiana. Katrina was one of the deadliest hurricanes in U.S. history. In Louisiana alone 1,464 people lost their lives and over 135 are still missing (Louisiana Department of Health and Hospitals, 2006). Although it may not be possible to correlate individual weather events to climate change, the catastrophic events An additional health-related consequence of climate change is related to air quality. The urban poor are also vulnerable because urban environments trap heat. Although it may not be possible to correlate individual weather events to climate change, the catastrophic events described above illustrate the challenge of mounting an effective public health response to such destructive weather events. During the New Orleans storm, for example, thousands of individuals and families were displaced and crowded into shelters; floodwaters were contaminated with sewage; and there was a lack of food and potable water which created concerns about the possibility of a communicable disease outbreak. The National Environmental Trust (2006) warned of additional concerns about exposure to the toxic stew of 600 million pounds of toxic chemicals released to floodwaters when chemical plants, petroleum refineries, and petroleum bulk storage facilities were destroyed in the flood. An additional health-related consequence of climate change is related to air quality. High temperatures, in the presence of sunlight and certain air pollutants such as volatile organic compounds and nitrogen oxides (emitted from motor vehicles, power plants, and other sources of combustion), result in the formation of ground level ozone. The higher the temperature and the more direct the sunlight, the more ozone is produced. Exposure to ozone is associated with increased risk of premature mortality; in fact there is an increase risk of premature mortality even at low levels of ozone (Bell, Peng, & Dominici, 2006). There is also a concern that as temperatures rise we can expect to see a rise in vector-transmitted diseases, such as malaria, West Nile Virus, and Dengue Fever. There are concerns that insects that transmit these diseases will mature faster, lay more eggs, and bite more frequently (Epstein, 2000; Reiter, 2001). Linacre and Geerts (2002) expressed concern that as temperatures increase, insects will migrate geographically to areas where they previously had not been able to thrive. However, Reiter noted that in the history of malaria, yellow fever, and dengue, "climate has rarely been the principal determinant of their prevalence or range" (p.141). Longstreth (2001) studied the special vulnerabilities of certain populations to the effects of climate change. Children are especially vulnerable since they may not have fully developed immune or heat-regulatory systems, because they breathe more air per pound than adults, and because they are more likely to play outside. The elderly are also at risk from extreme weather events which may result in falls, especially during evacuations; and they are more vulnerable to heat-related illness. Chronically ill people, such as persons with pre-existing heart or lung conditions, are at risk of illness or death from heat and air pollution. Immuno-compromised individuals are at higher risk of infectious diseases spread by contaminated food or water. The urban poor are also vulnerable because urban environments trap heat. Many of the urban poor may not have access to air conditioning or to cooled public spaces; nor may they have the resources to be able to seek early or preventative health care

## A2: CO2 Good – Environment

### Global Warming directly affects humans

Jane Kay, April 17, 2007 (Kay is a Chronicle Environment Writer) (<http://articles.sfgate.com/2007-04-17/news/17242239_1_heat-waves-climate-change-warming>)

Higher temperatures over the coming decades are expected to cause more smoggy days and heat waves, contributing to a greater number of illnesses and deaths in the United States, according to international climate scientists. Severe heat waves -- characterized by stagnant masses of warm air and consecutive nights with high minimum temperatures -- will intensify in the United States and Canada, according to the data on North America released Monday by the United Nations Intergovernmental Panel on Climate Change. Southern California, the Southwest and the upper Midwest are already experiencing drought. Late in the century, in Los Angeles, the number of heat wave days is projected to increase from 12 days a year to between 44 and 95 days, the report said. The number of heat wave days in Chicago is expected to increase by 25 percent. Just how much people and ecosystems suffer in North America, scientists reported, depends on how well greenhouse gases are controlled. And, the scientists cautioned, it depends on how well they plan for and try to prevent the damage. "Without increased investments in countermeasures, hot temperatures and extreme weather are likely to cause increased adverse health impacts," including effects from heat, storms, pollution and infectious disease, the report said. Adding to the problem is that the Baby Boomer population is aging as global warming worsens, increasing the number of people most at risk of dying in heat waves. Global warming is already affecting people's health, said Kristi Ebi, an epidemiologist from Virginia and lead author of a chapter on human health written for the international science panel. People will eventually better respond to heat waves with health care system improvements. They'll even adjust physiologically to warmer temperatures. "It's while all of this is changing when you have high health impacts. And that could be in the next few decades," Ebi said in an interview. The report singled out other health effects related to global warming, including: -- More smog. Warmer temperatures lead to greater concentrations of ground-level ozone, which forms on hot, sunny days when pollution from cars and other sources mix. Smog can damage lung tissue, increasing respiratory days when pollution from cars and other sources mix. Smog can damage lung tissue, increasing respiratory and heart disease and death. Even modest increases in smog can cause asthma in children.

## A2: CO2 Doesn’t Cause Warming

### Greenhouse gases lead to warming through feedback loops—established scientific consensus

Nicholas Stern, Head of the British Government Economic Service, 2007 (Former Head Economist for the World Bank, I.G. Patel Chair at the London School of Economics and Political Science, “The Economics of Climate Change: The Stern Review”, The report of a team commissioned by the British Government to study the economics of climate change led by Siobhan Peters, Head of G8 and International Climate Change Policy Unit, Cambridge University Press, p. 7-8)

The causal link between greenhouse gases concentrations and global temperatures is well established, founded on principles established by scientists in the nineteenth century. The greenhouse effect is a natural process that keeps the Earth’s surface around 30°C warmer than it would be otherwise. Without this effect, the Earth would be too cold to support life. Current understanding of the greenhouse effect has its roots in the simple calculations laid out in the nineteenth century by scientists such as Fourier, Tyndall and Arrhenius15. Fourier realised in the 1820s that the atmosphere was more permeable to incoming solar radiation than outgoing infrared radiation and therefore trapped heat. Thirty years later, Tyndall identified the types of molecules (known as greenhouse gases), chiefly carbon dioxide and water vapour, which create the heat-trapping effect. Arrhenius took this a step further showing that doubling the concentration of carbon dioxide in the atmosphere would lead to significant changes in surface temperatures. Since Fourier, Tyndall and Arrhenius made their first estimates, scientists have improved their understanding of how greenhouse gases absorb radiation, allowing them to make more accurate calculations of the links between greenhouse gas concentrations and temperatures. For example, it is now well established that the warming effect of carbon dioxide rises approximately logarithmically with its concentration in the atmosphere16. From simple energy-balance calculations, the direct warming effect of a doubling of carbon dioxide concentrations would lead to an average surface warming of around 1 °C. But the atmosphere is much more complicated than these simple models suggest. The resulting warming will in fact be much greater than 1 °C because of the interaction between feedbacks in the atmosphere that act to amplify or dampen the direct warming (Figure 1.4). The main positive feedback comes from water vapour, a very powerful greenhouse gas itself. Evidence shows that, as expected from basic physics, a warmer atmosphere holds more water vapour and traps more heat, amplifying the initial warming. Complex interactions within the system and estimate how changing greenhouse gas levels will affect the climate. Climate models use the laws of nature to simulate the radiative balance and flows of energy and materials. These models are vastly different from those generally used in economic analyses, which rely predominantly on curve fitting. Climate models cover multiple dimensions, from temperature at different heights in the atmosphere, to wind speeds and snow cover. Also, climate models are tested for their ability to reproduce past climate variations across several dimensions, and to simulate aspects of present climate that they have not been specifically tuned to fit. The accuracy of climate predictions is limited by computing power. This, for example, restricts the scale of detail of models, meaning that small-scale processes must be included through highly simplified calculations. It is important to continue the active research and development of more powerful climate models to reduce the remaining uncertainties in climate projections. The sensitivity of mean surface temperatures to greenhouse gas levels is benchmarked against the warming expected for a doubling of carbon dioxide levels from pre-industrial (roughly equivalent to 550 ppm CO2e). This is called the “climate sensitivity” and is an important quantity in accessing the economics of climate change. By comparing predictions of different state-of-the-art climate models, the IPCC TAR concluded that the likely range of climate sensitivity is 1.5° – 4.5°C. This range is much larger than the 1 °C direct warming effect expected from a doubling of carbon dioxide concentrations, thus emphasising the importance of feedbacks within the atmosphere. For illustration, using this range of sensitivities, if greenhouse gas levels could be stabilised at today’s levels (430 ppm CO2e), global mean temperatures would eventually rise to around 1 ° - 3°C above pre-industrial (up to 2°C more than today)18. This is not the same as the “warming commitment” today from past emissions, which includes the current levels of aerosols in the atmosphere (discussed later in this chapter).

## A2: SO2 Screw 1/2

### SO2 causes warming- multiple feedback loops- all other studies fail because they don’t assume other particles

Science Daily, 10 (Best Hope for Saving Arctic Sea Ice Is Cutting Soot Emissions, Say Researchers, July 30, 2010, <http://www.sciencedaily.com/releases/2010/07/100728092617.htm>)

The quickest, best way to slow the rapid melting of Arctic sea ice is to reduce soot emissions from the burning of fossil fuel, wood and dung, according to a new study by Stanford researcher Mark Z. Jacobson. His analysis shows that soot is second only to carbon dioxide in contributing to global warming. But, he said, climate models to date have mischaracterized the effects of soot in the atmosphere. Because of that, soot's contribution to global warming has been ignored in national and international global warming policy legislation, he said. "Controlling soot may be the only method of significantly slowing Arctic warming within the next two decades," said Jacobson, director of Stanford's Atmosphere/Energy Program. "We have to start taking its effects into account in planning our mitigation efforts and the sooner we start making changes, the better." To reach his conclusions, Jacobson used an intricate computer model of global climate, air pollution and weather that he developed over the last 20 years that included atmospheric processes not incorporated in previous models. He examined the effects of soot -- black and brown particles that absorb solar radiation -- from two types of sources. He analyzed the impacts of soot from fossil fuels -- diesel, coal, gasoline, jet fuel -- and from solid biofuels, such as wood, manure, dung, and other solid biomass used for home heating and cooking in many locations. He also focused in detail on the effects of soot on heating clouds, snow and ice. What he found was that the combination of both types of soot is the second-leading cause of global warming after carbon dioxide. That ranks the effects of soot ahead of methane, an important greenhouse gas. He also found that soot emissions kill more than 1.5 million people prematurely worldwide each year, and afflicts millions more with respiratory illness, cardiovascular disease and asthma, mostly in the developing world where biofuels are used for home heating and cooking. Jacobson's study will be published in *Journal of Geophysical Research (Atmospheres)*. Reducing soot could have immediate impact It is the magnitude of soot's contribution, combined with the fact that it lingers in the atmosphere for only a few weeks before being washed out, that leads to the conclusion that a reduction in soot output would start slowing the pace of global warming almost immediately. Greenhouse gases, in contrast, typically persist in the atmosphere for decades -- some up to a century or more -- creating a considerable time lag between when emissions are cut and when the results become apparent. Mark Jacobson found that eliminating soot produced by the burning of fossil fuel and solid biofuel could reduce warming above parts of the Arctic Circle in the next 15 years by up to 1.7 degrees Celsius. Jacobson found that eliminating soot produced by the burning of fossil fuel and solid biofuel could reduce warming above parts of the Arctic Circle in the next 15 years by up to 1.7 degrees Celsius. For perspective, net warming in the Arctic has been at least 2.5 degrees Celsius during the last century and is expected to warm significantly more in the future if nothing is done. The most immediate, effective and low-cost way to reduce soot emissions is to put particle traps on vehicles, diesel trucks, buses, and construction equipment. Particle traps filter out soot particles from exhaust fumes. Soot could be further reduced by converting vehicles to run on clean, renewable electric power. Jacobson found that although fossil fuel soot contributed more to global warming, biofuel-derived soot caused about eight times the number of deaths as fossil fuel soot. Providing electricity to rural developing areas, thereby reducing usage of solid biofuels for home heating and cooking, would have major health benefits, he said. Soot from fossil fuels contains more black carbon than soot produced by burning biofuels, which is why there is a difference in impact. Black carbon is highly efficient at absorbing solar radiation in the atmosphere, just like a black shirt on a sunny day. Black carbon converts sunlight to heat and radiates it back to the air around it. This is different from greenhouse gases, which primarily trap heat that rises from the Earth's surface. Black carbon can also absorb light reflecting from the surface, which helps make it such a potent warming agent. First model of its type Jacobson's climate model is the first global model to use mathematical equations to describe the physical and chemical interactions of soot particles in cloud droplets in the atmosphere. This allowed him to include details such as light bouncing around inside clouds and within cloud drops, which he said are critical for understanding the full effect of black carbon on heating the atmosphere. "The key to modeling the climate effects of soot is to account for all of its effects on clouds, sea ice, snow and atmospheric heating," Jacobson said. Because of the complexity of the processes, he said it is not a surprise that previous models have not correctly treated the physical interactions required to simulate cloud, snow, and atmospheric heating by soot. "But without treating these processes, no model can give the correct answer with respect to soot's effects," he said. Jacobson argues that leaving out this scale of detail in other models has led many scientists and policy makers to undervalue the role of black carbon as a warming agent. The strong global heating due to soot that Jacobson found is supported by recent findings of Veerabhadran Ramanathan, a professor of climate and atmospheric science at the Scripps Institute of Oceanography, who measures and models the climate effects of soot. "Jacobson's study is the first time that a model has looked at the various ways black carbon can impact climate in a quantitative way," said Ramanathan, who was not involved in the study. Black carbon has an especially potent warming effect over the Arctic. When black carbon is present in the air over snow or ice, sunlight can hit the black carbon on its way towards Earth, and also hit it as light reflects off the ice and heads back towards space. "It's a double-whammy over the ice surface in terms of heating the air," Jacobson said. Black carbon also lands on the snow, darkening the surface and enhancing melting. "There is a big concern that if the Arctic melts, it will be a tipping point for the Earth's climate because the reflective sea ice will be replaced by a much darker, heat absorbing, ocean below," said Jacobson. "Once the sea ice is gone, it is really hard to regenerate because there is not an efficient mechanism to cool the ocean down in the short term." Jacobson's work was supported by grants from the U.S. Environmental Protection Agency, NASA, the NASA high-end computing program and the National Science Foundation.

A2: SO2 Screw 2/2

### Sulfur effects are only temporary—longterm effects rip the arctic ozone layer apart

RANDOLPH E. SCHMID [July 4, 2011](http://www.physorg.com/archive/04-07-2011/), AP Science Writer Global warming pause linked to sulfur in China http://www.physorg.com/news/2011-07-global-linked-sulfur-china.html

But sulfur's cooling effect is only temporary, while the carbon dioxide from coal burning stays in Earth's atmosphere a long time. Chinese coal consumption doubled between 2003 and 2007, and that caused a 26 percent increase in global coal consumption, Kaufmann said. Now, Chinese leaders have recognized the effects of that pollution on their environment and their citizens' health and are installing equipment to scrub out the sulfur particles, Kaufmann said. Sulfur quickly drops out of the air if it is not replenished, while carbon dioxide remains for a long time, so its warming effects are beginning to be visible again, he noted. The plateau in temperature growth disappeared in 2009 and 2010, when temperatures lurched upward. Indeed, NASA and the [National Oceanic and Atmospheric Administration](http://www.physorg.com/tags/national+oceanic+and+atmospheric+administration/), have listed 2010 as tied for the warmest year on record, while the Hadley Center of the British Meteorological Office lists it as second warmest, after 1998. Sulfur's ability to cool things down has led some to suggest using it in a geoengineering feat to cool the planet. The idea is that injecting [sulfur compounds](http://www.physorg.com/tags/sulfur+compounds/)very high into the atmosphere might help ease global warming by increasing clouds and haze that would reflect sunlight. Some research has concluded that's a bad idea. Using enough sulfur to reduce warming would wipe out the protective Arctic ozone layer and delay recovery of the Antarctic ozone hole by as much as 70 years, according to an analysis by Simone Tilmes of the National Center for Atmospheric Research in Boulder, Colo. This is the ozone layer that is high above Earth and protects against harmful UV rays, not the ground level ozone that is a harmful pollutant. "While climate change is a major threat, more research is required before society attempts global geoengineering solutions," said Tilmes. Overall, global temperatures have been increasing for more than a century since the industrial revolution began adding gases like carbon dioxide to the air. But there have been similar plateaus, such as during the post-World War II era when industrial production boosted [sulfur](http://www.physorg.com/tags/sulfur/) emissions in several parts of the world, Kaufmann explained. Atmospheric scientists and environmentalists are concerned that continued rising temperatures could have serious impacts worldwide, ranging from drought in some areas, changes in storm patterns, spread of tropical diseases and rising sea levels.

## A2: Positive Feedback Loops 1/2

### Feedbacks are net positive—must act now to prevent runaway warming

James E. Hansen, Head of NASA Goddard Institute and Professor of Environmental Sciences @ Columbia U, April 2008

(Head of the NASA Goddard Institute for Space Studies in New York City and adjunct professor in the Department of Earth and Environmental Science at Columbia University, State of the Wild,“Tipping point: Perspective of a Scientist”, http://www.columbia.edu/~jeh1/2008/StateOfWild\_20080428.pdf)

Fast feedbacks—changes that occur quickly in response to temperature change—amplify the initial temperature change, begetting additional warming. As the planet warms, fast feedbacks include more water vapor, which traps additional heat, and less snow and sea ice, which exposes dark surfaces that absorb more sunlight. Slower feedbacks also exist. Due to warming, forests and shrubs are moving poleward into tundra regions. Expanding vegetation, darker than tundra, absorbs sunlight and warms the environment. Another slow feedback is increasing wetness (i.e., darkness) of the Greenland and West Antarctica ice sheets in the warm season. Finally, as tundra melts, methane, a powerful greenhouse gas, is bubbling out. Paleoclimatic records confirm that the long-lived greenhouse gases— methane, carbon dioxide, and nitrous oxide—all increase with the warming of oceans and land. These positive feedbacks amplify climate change over decades, centuries, and longer. The predominance of positive feedbacks explains why Earth’s climate has historically undergone large swings: feedbacks work in both directions, amplifying cooling, as well as warming, forcings. In the past, feedbacks have caused Earth to be whipsawed between colder and warmer climates, even in response to weak forcings, such as slight changes in the tilt of Earth’s axis.2 The second fundamental property of Earth’s climate system, partnering with feedbacks, is the great inertia of oceans and ice sheets. Given the oceans’ capacity to absorb heat, when a climate forcing (such as increased greenhouse gases) impacts global temperature, even after two or three decades, only about half of the eventual surface warming has occurred. Ice sheets also change slowly, although accumulating evidence shows that they can disintegrate within centuries or perhaps even decades. The upshot of the combination of inertia and feedbacks is that additional climate change is already “in the pipeline”: even if we stop increasing greenhouse gases today, more warming will occur. This is sobering when one considers the present status of Earth’s climate. Human civilization developed during the Holocene (the past 12,000 years). It has been warm enough to keep ice sheets off North America and Europe, but cool enough for ice sheets to remain on Greenland and Antarctica. With rapid warming of 0.6°C in the past 30 years, global temperature is at its warmest level in the Holocene.3 The warming that has already occurred, the positive feedbacks that have been set in motion, and the additional warming in the pipeline together have brought us to the precipice of a planetary tipping point. We are at the tipping point because the climate state includes large, ready positive feedbacks provided by the Arctic sea ice, the West Antarctic ice sheet, and much of Greenland’s ice. Little additional forcing is needed to trigger these feedbacks and magnify global warming. If we go over the edge, we will transition to an environment far outside the range that has been experienced by humanity, and there will be no return within any foreseeable future generation. Casualties would include more than the loss of indigenous ways of life in the Arctic and swamping of coastal cities. An intensified hydrologic cycle will produce both greater floods and greater droughts. In the US, the semiarid states from central Texas through Oklahoma and both Dakotas would become more drought-prone and ill suited for agriculture, people, and current wildlife. Africa would see a great expansion of dry areas, particularly southern Africa. Large populations in Asia and South America would lose their primary dry season freshwater source as glaciers disappear. A major casualty in all this will be wildlife.

A2: Positive Feedback Loops 2/2

### Small warming triggers positive feedbacks that cause huge climate changes

James E. Hansen, head of NASA Goddard Institute and professor of Environmental Sciences, Columbia University, 2008

(Adjunct Professor in the Department of Earth and Environmental Science at Columbia University. Al Gore’s science advisor. Briefing before the Committee on Energy Independence and Global Warming, US House of Representatives. “Twenty years later: tipping points near on global warming,” http://www.columbia.edu/~jeh1/2008/TwentyYearsLater\_20080623.pdf)

Climate can reach points such that amplifying feedbacks spur large rapid changes. Arctic sea ice is a current example. Global warming initiated sea ice melt, exposing darker ocean that absorbs more sunlight, melting more ice. As a result, without any additional greenhouse gases, the Arctic soon will be ice-free in the summer.

More ominous tipping points loom. West Antarctic and Greenland ice sheets are vulnerable to even small additional warming. These two-mile-thick behemoths respond slowly at first, but if disintegration gets well underway it will become unstoppable. Debate among scientists is only about how much sea level would rise by a given date. In my opinion, if emissions follow a business-as-usual scenario, sea level rise of at least two meters is likely this century. Hundreds of millions of people would become refugees. No stable shoreline would be reestablished in any time frame that humanity can conceive.

## A2: Ice Age 1/2

### Warming causes ice age—ocean conveyor

Waterman 11. (6/30/11. Melissa, a freelance writer who specializes in science and the marine environment. “Marine Matters: Hot? Cold? Check the Ocean Conveyor Belt” The Free Press. http://freepressonline.com/main.asp?SectionID=50&SubSectionID=72&ArticleID=13520)

Our earth is a watery world. The deep currents moving slowly within the world's oceans are powered not by the wind but by differences in temperature and salinity. These currents transfer heat from equatorial regions to the north. Cold winds off Canada begin this process, cooling North Atlantic water east of Greenland and in the Labrador Sea and increasing its salinity through evaporation. The dense cold water sinks and begins moving southward along the very depths of the Atlantic. Meanwhile, warmer water moves north to replace the North Atlantic water that has sunk. This is just the beginning of the great ocean conveyor belt, a system of deep currents that recirculate heat and water through all the world's oceans. What's important about this conveyor system is that by moving heat around, it keeps the next ice age at bay. The earth has undergone numerous ice ages in the past. These mammoth shifts in the world's climate occur every 100,000 years or so and are separated by relatively brief periods of warmth, lasting about 10,000 to 15,000 years. We are at the end of just such a warm period now. Just a decade ago, scientists thought that each ice age crept up on the world with gradual cooling of summer temperatures. Recent research indicates the contrary, that the ice ages did not come in gently over time but rather occurred abruptly, popping up within a matter of centuries or even decades. And the reason for these huge changes in the climate? The ocean conveyor belt. The key to the ocean conveyor belt is that dense water sinking in the Arctic. The reason the water sinks at all is because it is both cold and very salty, hence heavy. However, if you dilute the salinity of that water, it won't sink. If it doesn't sink, the conveyor belt effectively shuts down. Once, long ago, a great lake formed by the glaciers called Lake Aggasiz dumped its entire basin of freshwater into the North Atlantic, allegedly within a matter of days. This tremendous influx of freshwater so reduced the salinity of the North Atlantic surface water that the water failed to sink. This caused a severe dip in northern hemisphere temperatures, which scientists found recorded in the ice sheets of Greenland. Massive volumes of saltwater, an amount estimated to be equivalent to the outfall of 30 Amazon rivers, sink each winter just east of Greenland. So much water sinking causes warm water from the equator to flow much farther north than it might otherwise do. As a result, the Gulf Stream brings warm water north and east along the U.S. coast, merges into the warm North Atlantic Current to cross the Atlantic, and then flows north along the Norwegian coast. As a result, Europe is a lot warmer than it ought to be, about nine to 18 degrees F warmer. Look at a map of the globe; compare major cities in the United States with major cities in Europe. Rome lies near the same latitude, 42°N, as Chicago. London and Paris, fairly temperate cities in the winter, are close to the 49°N latitude line that, west of the Great Lakes, separates the United States from Canada. Berlin is up at 52°, Copenhagen and Moscow at about 56°. Oslo is nearly at 60°N, at the same latitude as Anchorage, Alaska, but considerably warmer in the winter. If the ocean conveyor belt shuts down because the ice sheets of the north begin to melt due to global warming, Europe, as well as the rest of the world, is in trouble. Turn off the Gulf Stream and Iceland would become one large ice cap. Ireland's climate would be transformed to that of Spitzbergen. Winters in Scandinavia would become so cold that tundra would replace forests. The Baltic Sea would be permanently ice covered, as would much of the ocean between Greenland and Scandinavia. The climate effect would be felt throughout the world, not just in Europe. Rainfall patterns would dramatically shift. Temperatures would fall. The atmosphere would become dustier. And this shift to a new and cold world could occur within decades.

A2: Ice Age 2/2

### No extinction from ice age—technology solves

Croatian Times 10. (10/02/10. “Croat scientist warns ice age could start in five years” http://www.croatiantimes.com/news/General\_News/2010-02-10/8836/Croat\_scientist\_warns\_ice\_age\_could\_start\_in\_five\_years) \*quoting Vladimir Paar—physicist at Croatia’s Zagreb University. \*\*This card has been gender modified

The Zagreb based scientist says it will still be possible for humans to survive in the ice age, but the spending on energy will be enormous. "Food production also might be a problem. It would need to be produced in greenhouses with a lot of energy spent to heat it", commented the professor, who remains optimistic despite his predictions. He said: "The nuclear energy we know today will not last longer than 100 years as we simply do not have enough uranium in the world to match the needs in an ice age. But I'm still optimistic. There is the process of nuclear fusion happening on the Sun. The fuel for that process is hydrogen and such a power plant is already worked on in France as a consortium involving firms from Marseille and the European Union, the US, Russia, China, Japan and South Korea. The head of the project is a Japanese expert, and former Japanese ambassador in Croatia", Vladimir Paar revealed. He said the building of the new technology power plant will take at least another 10 years. "In 40 years we'll know how it functions. That would be a solution that could last for thousands of years. We have a lot of hydrogen and the method is an ecological one", the professor concluded.

### Next Ice Age is 50,000 to 130,000 years away

Brock 11. (3/19/11. Chris, staff writer. “Taking long, long view on climate change” Watertown Daily Times. http://www.watertowndailytimes.com/article/20110319/CURR04/303199998/?loc=interstitialskip)

Mr. Stager writes that most climate models predict another ice age at the year 50,000. Humans, he said, have stopped that "in its tracks" because of carbon dioxide emissions. The next ice age will arrive around the year 130,000. But not if "we burn through all our remaining coal reserves during the next century or so," Mr. Stager writes. If we do that, he said, the next ice age won't hit for the next half million years.

## A2: Winter Wheat

### Global warming helps weeds thrives—destroys positive effects it has on other plants

Weed Science Society of America Feb. 18, 2011 9:17am Carbon Dioxide Pollution Helps Weeds Thrive, Lowers Impact of Herbicides http://cornandsoybeandigest.com/crop-chemicals/carbon-dioxide-pollution-helps-weeds-thrive-lowers-impact-herbicides

Increased levels of carbon dioxide in the atmosphere benefit at least one species: weeds. Carbon dioxide acts as a fertilizer to invasive exotic grasses, resulting in higher growth rates and larger leaves. These stronger plants are also proving more resistant to the world’s most important [herbicide](http://www.cornandsoybeandigest.com/herbicides), glyphosate, commercially known as Roundup. A [study](http://www.wssajournals.org/doi/full/10.1614/WS-D-10-00080.1) published in the current issue of the journal [Weed Science](http://www.wssajournals.org/loi/wees) reports the effects of elevated carbon dioxide levels on four species of grass. The research also gauged the tolerance of these plants to the most widely used herbicide for weed control, glyphosate. The four species tested are all invasive exotic plants in Australia that previously have been chemically controlled with glyphosate. The plants were grown in glasshouse experiments at ambient and elevated carbon dioxide levels. Mature plants were then sprayed with the recommended amount of glyphosate. When treated with the herbicide, three of the four species showed a significantly higher survival rate under the elevated carbon dioxide level compared with ambient levels. The herbicide works by inhibiting an enzyme the plant needs for biosynthesis. However, when the plant is exposed to higher levels of carbon dioxide, it increases its growth and biomass production in a way that heightens its tolerance to glyphosate. The plant is experiencing reduced stomatal conductance and creating greater total leaf area. Atmospheric carbon dioxide has increased greatly in the past two decades because of the burning of fossil fuels and changes in land use. Preindustrial carbon dioxide levels were rated at 280 parts per million (ppm), while 2005 levels reached 379 ppm. By the year 2100, it is predicted that carbon dioxide will reach 700 ppm; this level was represented in the elevated growth test. With carbon dioxide helping to create a better weed, use of herbicides may be increased to counter the effect. More weeds and larger amounts of herbicides could have significant economic and environmental impacts.

### Climate change hurts food supplies—Carbon dioxide cant keep up

Justin Gillis June 4, 2011 is an assistant business editor at The New York Times, in charge of the paper's coverage of food, agriculture and energy. He joined the Times last year after a dozen years as an editor and reporter at The Washington Post, and before that, a dozen years at The Miami Herald. A Warming Planet Struggles to Feed Itself http://www.nytimes.com/2011/06/05/science/earth/05harvest.html?pagewanted=1&\_r=1

Now, the latest scientific research suggests that a previously discounted factor is helping to destabilize the food system: [climate change](http://topics.nytimes.com/top/news/science/topics/globalwarming/index.html?inline=nyt-classifier). Many of the failed harvests of the past decade were a consequence of weather disasters, like floods in the United States, drought in Australia and blistering heat waves in Europe and Russia. Scientists believe some, though not all, of those events were caused or worsened by human-induced global warming. Temperatures are rising rapidly during the growing season in some of the most important agricultural countries, and a paper published several weeks ago found that this had shaved several percentage points off potential yields, adding to the price gyrations. For nearly two decades, scientists had predicted that climate change would be relatively manageable for agriculture, suggesting that even under worst-case assumptions, it would probably take until 2080 for [food prices](http://topics.nytimes.com/top/reference/timestopics/subjects/f/food_prices/index.html?inline=nyt-classifier) to double. In part, they were counting on a counterintuitive ace in the hole: that rising carbon dioxide levels, the primary contributor to global warming, would act as a powerful plant fertilizer and offset many of the ill effects of climate change. Until a few years ago, these assumptions went largely unchallenged. But lately, the destabilization of the food system and the soaring prices have rattled many leading scientists. “The success of agriculture has been astounding,” said [Cynthia Rosenzweig](http://www.giss.nasa.gov/staff/crosenzweig.html), a researcher at NASA who helped pioneer the study of climate change and agriculture. “But I think there’s starting to be premonitions that it may not continue forever.” A scramble is on to figure out whether climate science has been too sanguine about the risks. Some researchers, analyzing computer forecasts that are used to advise governments on future crop prospects, are pointing out what they consider to be gaping holes. These include a failure to consider the effects of extreme weather, like the floods and the heat waves that are increasing as the earth warms. A rising unease about the future of the world’s food supply came through during interviews this year with more than 50 agricultural experts working in nine countries. These experts say that in coming decades, farmers need to withstand whatever climate shocks come their way while roughly doubling the amount of food they produce to meet rising demand. And they need to do it while reducing the considerable environmental damage caused by the business of agriculture.

## A2: Warming Inevitable

### Global warming has not passed a ‘tipping point’; that is a notion merely used to create climate hysteria.

Senator Inhofe, 2007, senator on the US Senate Committee on Environment and ublic Works, 2007: Global Warming Alarmism Reaches a “Tipping Point”, <http://epw.senate.gov/public/index.cfm?FuseAction=Minority.Speeches&ContentRecord_id=dceb518c-802a-23ad-45bf-894a13435a08>

All the while, activists like former Vice President Al Gore repeatedly continue to warn of a fast approaching climate "tipping point." I agree with Gore. Global warming may have reached a "tipping point." The man-made global warming fear machine crossed the "tipping point" in 2007. I am convinced that future climate historians will look back at 2007 as the year the global warming fears began crumbling. The situation we are in now is very similar to where we were in the late 1970's when coming ice age fears began to dismantle. Remember, it was Newsweek Magazine which in the 1970's proclaimed meteorologists were "almost unanimous" in their view that a coming Ice Age would have negative impacts. It was also Newsweek in 1975 which originated the eerily similar "tipping point" rhetoric of today: *Newsweek* wrote on April 28, 1975 about coming ice age fears: "The longer the planners delay, the more difficult will they find it to cope with climatic change once the results become grim reality." Of course Newsweek essentially retracted their coming ice age article 29 years later in October 2006. In addition, a 1975 National Academy of Sciences report addressed coming ice age fears and in 1971, NASA predicted the world "could be as little as 50 or 60 years away from a disastrous new ice age." Today, the greatest irony is that the UN and the media's climate hysteria grows louder as the case for alarmism fades away. While the scientific case grows weaker, the political and rhetorical proponents of climate fear are ramping up to offer hefty tax and regulatory "solutions" both internationally and domestically to "solve" the so-called "crisis." Skeptical Climatologist Dr. Timothy Ball formerly of the University of Winnipeg in Canada wrote about the current state of the climate change debate earlier this month:   "Imagine basing a country's energy and economic policy on an incomplete, unproven theory - a theory based entirely on computer models in which one minor variable (CO2) is considered the sole driver for the entire global climate system." And just how minor is that man-made CO2 variable in the atmosphere? Meteorologist Joseph D'Aleo, the first Director of Meteorology at The Weather Channel and former chairman of the American Meteorological Society's (AMS) Committee on Weather Analysis and Forecasting, explained in August how miniscule mankind's CO2 emissions are in relation to the Earth's atmosphere. "If the atmosphere was a 100 story building, our annual anthropogenic CO2 contribution today would be equivalent to the linoleum on the first floor," D'Aleo wrote.

## Qualifications Outweigh

### A majority of the climate debate is entirely settled—we don’t need 100% certainly, just consensus. Media skepticism and denier research should be rejected. Climate scientists are non-biased, but the same cannot be said for their counter-parts.

Lewandowsky and Ashley 6/24/11 (Stephan, Professor of Cognitive Studies at the University of Western Australia, and Michael, Professor of Astrophysics at the University of New South Wales, “The false, the confused and the mendacious: how the media gets it wrong on climate change,” http://theconversation.edu.au/the-false-the-confused-and-the-mendacious-how-the-media-gets-it-wrong-on-climate-change-1558)

Certainty in science If you ask a scientist whether something is “settled” beyond any doubt, they will almost always reply “no”. Nothing is 100% certain in science. So how certain is climate science? Is there a 50% chance that the experts are wrong and that the climate within our lifetimes will be just fine? Or is there a 10% chance that the experts are wrong? Or 1%, or only 0.0001%? The answer to these questions is vital because if the experts are right, then we must act to avert a major risk. Dropping your phone Suppose that you lose your grip on your phone. Experience tells us that the phone will fall to the ground. You drop a phone, it falls down. Fact. Science tells us that this is due to gravity, and no one doubts its inevitability. However, while science has a good understanding of gravity, our knowledge is only partial. In fact, physicists know that at a very deep level our theory of gravity is inconsistent with quantum mechanics, so one or both will have to be modified. We simply don’t know for sure how gravity works. But we still don’t jump off bridges, and you would be pretty silly to drop your phone onto a concrete floor in the hope that gravity is wrong. Climate change vs. gravity: Greater complexity, comparable certainty Our predictions of climate change aren’t as simple as the action of gravity on a dropped phone. The Earth is a very complex system: there are natural effects like volcanoes, and variations in the sun; there are the vagaries of the weather; there are complicating factors such as clouds, and how ice responds; and then there are the human influences such as deforestation and CO2 emissions. But despite these complexities, some aspects of climate science are thoroughly settled. We know that atmospheric CO2 is increasing due to humans. We know that this CO2, while being just a small fraction of the atmosphere, has an important influence on temperature. We can calculate the effect, and predict what is going to happen to the earth’s climate during our lifetimes, all based on fundamental physics that is as certain as gravity. The consensus opinion of the world’s climate scientists is that climate change is occurring due to human CO2 emissions. The changes are rapid and significant, and the implications for our civilisation may be dire. The chance of these statements being wrong is vanishingly small. Scepticism and denialism Some people will be understandably sceptical about that last statement. But when they read up on the science, and have their questions answered by climate scientists, they come around. These people are true sceptics, and a degree of scepticism is healthy. Other people will disagree with the scientific consensus on climate change, and will challenge the science on internet blogs and opinion pieces in the media, but no matter how many times they are shown to be wrong, they will never change their opinions. These people are deniers. The recent articles in The Conversation have put the deniers under the microscope. Some readers have asked us in the comments to address the scientific questions that the deniers bring up. This has been done. Not once. Not twice. Not ten times. Probably more like 100 or a 1000 times. Denier arguments have been dealt with by scientists, again and again and again. But like zombies, the deniers keep coming back with the same long-falsified and nonsensical arguments. The deniers have seemingly endless enthusiasm to post on blogs, write letters to editors, write opinion pieces for newspapers, and even publish books. What they rarely do is write coherent scientific papers on their theories and submit them to scientific journals. The few published papers that have been sceptical about climate change have not withstood the test of time. The phony debate on climate change So if the evidence is this strong, why is there resistance to action on climate change in Australia? At least two reasons can be cited. First, as The Conversation has revealed, there are a handful of individuals and organisations who, by avoiding peer review, have engineered a phony public debate about the science, when in fact that debate is absent from the one arena where our scientific knowledge is formed. These individuals and organisations have so far largely escaped accountability. But their free ride has come to an end, as the next few weeks on The Conversation will continue to show. The second reason, alas, involves systemic failures by the media. Systemic media failures arise from several presumptions about the way science works, which range from being utterly false to dangerously ill-informed to overtly malicious and mendacious. The false Let’s begin with what is merely false. A tacit presumption of many in the media and the public is that climate science is a brittle house of cards that can be brought down by a single new finding or the discovery of a single error. Nothing could be further from the truth. Climate science is a cumulative enterprise built upon hundreds of years of research. The heat-trapping properties of CO2 were discovered in the middle of the 19th century, pre-dating even Sherlock Holmes and Queen Victoria. The resulting robust knowledge will not be overturned by a single new finding. A further false presumption of the media is that scientific opinions must somehow be balanced by an opposing view. While balance is an appropriate conversational frame for the political sphere, it is wholly inappropriate for scientific issues, where what matters is the balance of evidence, not opinion. At first glance, one might be tempted to forgive the media’s inappropriate inclusion of unfounded contrarian opinions, given that its function is to stimulate broad debate in which, ideally, even exotic opinions are given a voice. But the media by and large do not report the opinions of 9/11 “truthers” who think that the attacks were an “inside job” of the Bush administration. The media also do not report the opinion of people who believe Prince Phillip runs the world’s drug trade. The fact that equally outlandish pseudo-scientific nonsense about climate science can be sprouted on TV by a cat palmist is evidence not of an obsession with balance but of a striking and selective failure of editorial responsibility. What is needed instead of the false symmetry implied by “balance” is what the BBC calls impartiality – fact-based reporting that evaluates the evidence and comes to a reality-based conclusion. The dangerously ill-formed An example of a dangerously ill-informed opinion on how science works is the widely propagated myth that scientists somehow have a “vested interest”, presumably financial, in climate change. This myth has been carefully crafted by deniers to create a chimerical symmetry between their own ties to political and economic interests and the alleged “vested interests” of scientists. In actual fact, climate scientists have as much vested interest in the existence of climate change as cancer researchers do in the existence of the human papilloma virus (HPV). Cancer researchers are motivated by the fact that cervical cancer kills, and the scientists who developed the HPV vaccine did so to save lives, not to get their grants renewed. Climate scientists are likewise motivated by the fact that climate change kills 140,000 people per year right at this very moment, according to the World Health Organization. The scientists who have been alerting the public of this risk for nearly 20 years did so to save lives, not to get their grants renewed. Climate scientists are being motivated by the realisation that humanity has got itself into serious trouble with climate change, and it will need the best scientific advice to navigate a solution. As scientists, we ask not for special consideration by the media, but simply for the same editorial responsibility and quality control that is routinely applied to all other arenas of public discourse. Selective failure of quality control and editorial responsibility when it comes to climate change presents a grave public disservice. The malicious Finally, no truthful analysis of the Australian media landscape can avoid highlighting the maliciousness of some media organisations, primarily those owned by Newscorp, which are cartoonish in their brazen serial distortion of scientists and scientific findings. Those organisations have largely escaped accountability to date, and we believe that it is a matter of urgency to expose their practice. For example, it is not a matter of legitimate editorial process to misrepresent what experts are telling Newscorp reporters — some of whom have been known to apologize to scientists in advance and off the record for their being tasked to return from public meetings, not with an actual news story but with scathing statements from the handful of deniers in the audience. It is not a matter of legitimate editorial process to invert the content of scientific papers. It is not a matter of legitimate editorial process to misrepresent what scientists say. It is not a matter of legitimate editorial process to prevent actual scientists from setting the record straight after the science has been misrepresented. None of those sadly common actions are compatible with legitimate journalistic ethics, and they should have no place in a knowledge economy of the 21st century. The very fact that society is wracked by a phony debate where there is none in the scientific literature provides strong evidence that the Australian media has tragically and thoroughly failed the Australian public.

## Idso Indict

### Your authors’ research is funded by Exxon Mobile

RP Siegel, an author and inventor whose passion runs along literary, environmental, and technological lines, publications include business and technical articles as well as the recent sustainability novel, Vapor Trails, A Professional Engineer and a prolific inventor with 44 patents, RP is also President of Rain Mountain LLC and is the Founder and Executive Director of Cool Rochester, a non-profit agency devoted to reducing the carbon footprint of Rochester, New York by one billion pounds by 2012, also blogs regularly to triplepundit.com, Triplepundit.com, “Nine Out of Ten Top Climate Deniers Linked to ExxonMobil”, http://www.triplepundit.com/2011/05/nine-ten-top-climate-deniers-linked-exxonmobil, May 9th, 2011

A recent analysis conducted by Carbon Brief which investigated the authors of more than 900 published papers that cast doubt on the science underlying climate change, found that nine of the ten most prolific had some kind of relationship with ExxonMobil. Links to these papers were proudly displayed on the denialist Global Warming Policy Foundation website, where they are still fanning the dying embers of Climategate hoping something will catch, under the heading, “900+ Peer-Reviewed Papers Supporting Skepticism Of ‘Man-Made’ Global Warming (AGW) Alarm.” The top ten contributors to this list were responsible for 186 of the 938 papers cited. Foremost among them was Dr Sherwood B Idso, who personally authored 67 of them. Idso is the president of the Center for the Study of Carbon Dioxide and Global Change, an ExxonMobil funded think tank. The second most prolific, Dr Patrick J Michaels, a senior fellow at the Cato Institute, receives roughly 40% of his funding from the oil industry. Number 3 on the list, Agricultural Biologist Bruce Kimball co-authored all of his papers with the aforementioned Dr. Idso. The report does not mention the Koch Brothers, who as we know, spent twice as much supporting climate denial groups as Exxon Mobil did. The researchers utilized the website Needlebase to help conduct their analysis. The idea of maintaining an atmosphere of doubt in order to keep consumers from changing their behavior is not a new one. It was developed by the tobacco industry decades ago, in their efforts to dispel research results linking second hand smoke exposure to cancer and keep the public confused on the issue. A recent book on these tactics by Naomi Oreskes and Erik M. Conway, entitled Merchants of Doubt explores “how ideology and corporate interests, aided by a too-compliant media, have skewed public understanding of some of the most pressing issues of our era.”